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1. Idiergy

“Synergy” is often explained with the expression $2+2=5$. The idea in the expression is to show how some mergers or combinations of activities or units yield effects not included in the separate parts. Something is added by the combination, something that did not exist before the merging of the two parts. Synergy, as a concept, is so well known and widely used that there is no need to delve into it more deeply.

There are, however, two things worth noting. Firstly, that there does not seem to be any unique common mechanism behind the concept. Rather it seems to be a kind of family concept, a name given to a series of more or less disparate phenomena. Secondly, there are probably as many examples of the opposite effect, i.e., of situations where $2+2=3$. This means that the outcome of a combination of two phenomena or two activities is inferior – in some dimension – to what they would have generated separately. One skilled violin player, e.g., performing the violin solos in Vivaldi’s *Four Seasons*, is usually a highly enjoyable experience. Adding another, however skilled, playing the same instrument at the same time, would not add much to the musical experience. The example is trivial, as are many where we know from experience that, as the saying goes, adding more cooks does not improve the broth.

“Synergy” is, however, mostly used as a rather loosely applied concept in everyday economic language. Its importance, nevertheless, is not insignificant, as it helps to spread shared beliefs about what are assumed to be economic laws. The most dominant myth in this connection, perhaps, is that of the “economies of scale”. Another field where synergy is commonly used as an argument is that of corporate mergers. Mergers are almost always justified by the synergy effects – the promise of benefiting from an existing synergy potential – that the take-over is assumed to bring.

With this as a conceptual background I shall here introduce another concept – stressing the opposite effect – called “*idiergy*”. (The base is the opposite of the Greek “syn” (together) i.e., “idios” (ἴδιος, alone, private).)¹ By “idiergy”, then, is meant the added dynamic effect – in some dimension or other – which is produced by demarcation or by taking or keeping something apart, by delineating it into parts, by cutting it to pieces. The dynamics in question can, maybe, best be described with a technological metaphor. A transistor consists, basically, of an electric current interrupted by a thin insulating layer of silicon. The interruption of the current – “switching it on and off” – results into two power fields, and gives the effect we call a transistor. A micro-processor, again, is basically a long, complex network of interconnected transistors. Hundreds or thousands of autonomous transistors, each with its own borders, are connected in a complicated way – but the important point is, that they are kept apart – they each have an autonomous internal function, even when connected.

From two small holes in the wall, thus, issues an unlimited or unstructured power of 240 volts. When it is broken down into thousands of small parts, connected in a network of immense complexity and sophistication, it becomes a computer, a video game or, say, Beethoven’s 9th symphony.

¹ A word and an explanation given to me by my former colleague, Prof. em. Rolf Westman at Åbo Akademi University.



Another example of idiergy, very close to everybody, but maybe less well known, is the neuron, the brain cell. Every human brain consists of hundreds of billions of neurons. Below (Figure 1) we can see one of Santiago Ramon y Cajal's classical drawings of a human neuron, from 1904. The "hairy" tangle around the *soma* (the slightly fatter centre) in the neuron are the *dendrites* – in reality up to 10,000 for each neuron – receiving signals from other neurons. The thick "cable" stretching downwards from the soma, again, is the *axon*, forwarding signals to other neurons. (For a more detailed description, see Changeux, 1997.)

What is of interest in our perspective, is that each neuron – the complete setup of soma, dendrites and axon – is an autonomous whole, one brain cell. It works like an automaton, like a chemically charged miniscule battery, which automatically fires electrical impulses at a rather high and more or less constant rate. At the point where the extensions of the axon reach a dendrite of another neuron, the *synapse*, the electrical impulse gives rise to a chemical process, a discharge of *neurotransmitters*, which "jump" over the small gap between the transmitting axon and the receiving dendrite. These in turn trigger an electrical impulse in the receiving neuron. The neurons have no direct physical contact with each other, but the firing of one, mediated by the chemical flow over the gap, activates a firing, or a change in the firing pattern, of the next neuron. Each autonomous and more or less automatic mechanism of charging/discharging is connected to maybe hundreds or thousands of others, in an immense and recursively endless mesh. Each of them is its own whole, enclosed and functioning within its own borders, and at the same time connected in another way to other parts in a sophisticated pattern.

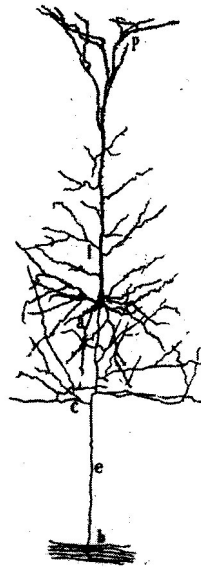


Figure 1: Ramon y Cajal's drawing of a neuron from a human brain. The picture can be found in almost any good textbook in the subject. (In this case it is taken from Edelman and Tononi, 2001.)

Now, let us just for a minute consider what we would have, if there were no borders at all. What effects would we get, if the whole mess of a hundred billion neurons, each with up to ten thousand interconnecting cables, functioned as a homogenous electrical mesh, without any chemical "switches"? If the whole brain merely resembled one long and infinitely thin cable, connecting, e.g., the eye to the hand, jumbled together into a messy lump with a low electrical charge.

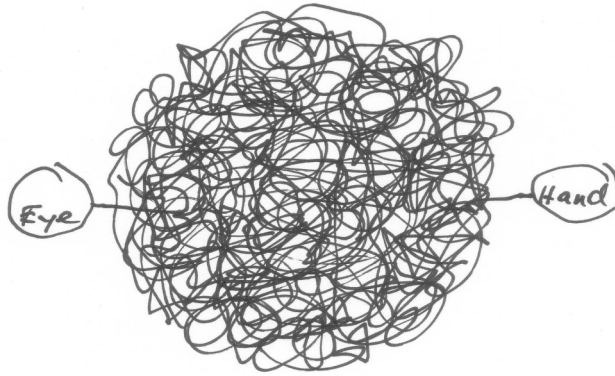


Figure 2: A brain envisaged as an almost endless, infinitely thin cable, jumbled together in a messy lump.

Topologically this “one-line brain” is identical with the one in figure 3, below, namely just a single cable carrying an electrical signal from a point of input, e.g. the “eye”, to a point of output, the “hand”. The only conceivable effect, then, might be a light heating of the skull. No thinking, no feeling, no playing, no symphonies.



Figure 3: The same “one-line brain” when straightened out.

The synapse, thus, is a border, keeping each neuron apart from the others but, at the same time, enabling contacts of a kind. The central point of brains is, that they consist of cells that are separated – idiery – but still connected.

Idiery, accordingly, might be described as a dynamic force or mechanism by which four, if divided into two twos, equals five – $4/2 = (2.5 \text{ and } 2.5) = 5$. By putting up borders, by dividing, by taking apart, and by restructuring the pieces, we get an effect greater than or different from the input of the whole. (And, as noted regarding synergy, we probably cannot expect this positive effect in all cases.)

Many empirical organizational examples of this effect can be pointed out. Hierarchy as such is clearly a question of idiery: By laying out borders of authority, of responsibility and of tasks, we get a higher level of effectiveness from the whole. Another example can be found in the division of the personnel of an organisation into those who give orders and those who obey them – one group specializing in knowing and requiring, the other in obeying and doing. Whereas the main interest and motive impelling a general may be, say, to annihilate the economic and military base of another country, a common soldier may be driven just by a wish to act so that he survives for one more day. The example is not perhaps a pleasant one to acknowledge, but nevertheless it describes one of the central pillars in the logic of military force. Generals use soldiers as instruments or pawns.

In a way, organization as such could be seen as utilizing an existing *idiergic potential*. At the same time, however, we can conjecture that idiery in the next step may be utilized in inter-connected structures of synergy – like a set of *Russian dolls*. The two phenomena form a



recursive balance, a dance of idiergy and synergy. In this perspective, advanced organization might be seen as ever more complex combinations, balancing idiergy and synergy. Even if the interest in complexity has been growing, within the management sciences it has been rather limited. In modernism's search for the beauty of simplicity – Occam's razor once again – it has aimed mainly for simple and unambiguously universal descriptions and explanations, and has in this way, due probably to pure carelessness, blinded itself to reality's manifest complexity and dynamic changes. Setting up boundaries, isolating parts which are then connected in sophisticated patterns, means creating structures, organising. Structure, in this way, *is* idiergy.

What, then is a border? On the most basic level, it seems, a border can be defined as a discontinuity – in a dimension of relevance, in any dimension of relevance. This means, that what is common to borders, is a breach in a continuity, a change in a linear function of some kind. This discontinuity delimits and changes something in such a way, that – as a consequence of the discontinuity – it forms a whole by itself.

Let us take a well known continuity, silence. Think of a long period of silence, then a short whistle, and then silence again. It is the breaking of the silence that makes the whistle; that makes it possible for you to notice it. Take a tone, a C. Let it sound continuously, without any change. After a time you will not even notice it – it is monotonous in the fundamental meaning of the word. But break the tone, put in a discontinuity, put in many of them. What you get, are different tones, maybe even a simple melody. Throw in some discontinuities in the separations as well, different lengths of the tones. Make continuities in the discontinuities, bunching them together in rhythmical “packets”. Add different (!) instruments, syncopate. Put in some tropes – more or less standardised sub-groups of melody – here and there. What you will get – depending, of course, on your skill – may be a symphony or a rock concert. In layer upon layer, in boxes within boxes, music is shaped by discontinuities and borders or, adding complexity, by discontinuities breaking our extrapolated expectations of discontinuities. And so on. Music, as a whole, *is* idiergy.

My argument is, thus, that borders *per se* create dynamic forces, that they give rise to power fields which change and enlarge the dynamics of the system which is taken or kept apart. The argument here is that this is *per se* an important structuring mechanism – or set of mechanisms. At first glance, two perspectives seem interesting: One is the question of *the border area as a dynamic field*. Another is the border's effect in *creating a whole*. Below I shall mainly try to dig more deeply into the first question.



2. The moving border of chaos

First, let us make an excursion into popularised genetics. The basic building stone of life, the genetic material, consists of long chains of four amino acids. The macro molecules of DNA make up man's 23 pairs of chromosomes; the long spiralling strings of genes. The genes, in turn, consist of combinations of the four basic units of DNA, the nucleotides usually named A, C, G, and T (adenine, cytosine, guanine, and thymine). Each gene, then, is formed as a long chain of nucleotides in an order which, to the untrained eye, seems to be completely random, ...CAAACGTGGGGGTAAA..... As Richard Lewontin notes (2000, p. 140) "A typical gene might consist of 10,000 basic units, and since there are four possibilities for each position in the string, the number of different possible kinds of genes is a great deal larger than what is usually called 'astronomically large'.

The possible combinations, he points out, would add up to a 1 followed by 6,020 zeroes, meaning that the DNA string, thus, "... is like a code with four different letters whose arrangements in messages thousands of letters long are of infinite variety. Only a small fraction of the possible messages can specify the form and content of a functioning organism, but that is still an astronomically large number". (Lewontin, 2000, p. 140)

For man, as shown in the results of the Human Genome Project, that number lies around 30,000 (a 3 followed by 4 zeroes). Considering that we have many genes in common with other organisms, and that they share many that we do not share with them, the total number of different functioning combinations – genes – still seems to be but an insignificant fraction of all possible combinations.

Using a simple metaphor, we can see each gene as an autonomous package, a small fragment of a melody, a trope. It is a whole by itself – even if it functions in a complex relationship with other genes and with the surrounding cell, the surrounding tissue, the surrounding body – and the external environment. It is its own musical variation on only four basic tones. Man, looked at in this metaphorical perspective, constitutes an immense symphony, composed of the same four tones. This in fact goes for organic life as a whole – an expanding musical universe built on no more than four tones. The genome of a living organism, the *double helix*, could be seen as the thick musical score that serves as the base for that special symphony it is going to play – not forgetting, of course, the importance of the conductor, the musicians, the audience and the architectonic features of the concert hall.

Since Crick and Watson won the Nobel Prize in 1953 for discovering the basic structure of "the double helix", this has become something like common knowledge and is a well established expression in everyday language. The HUGO project, moreover, has led to a more or less complete mapping of the human genome. The dynamics of that genome, however, are only superficially understood, even if we now know that it is much more intricate and complex than indicated by the extremely simplified description given above. Still, it shows the basic logic.²

² But it is worth noting that one of the main insights resulting from the HUGO project was that the genes are far too few to be able to determine in detail the traits of an individual. Instead, now, we must regard the whole process as an *epigenetic* one, in which each step is influenced by the results of each earlier step, acting in unison with influences from the environment at each foregoing step. In this process, one and the same gene may come back into action many times, at different phases, with a completely different task on each occasion.



The genes are interesting in other ways, too. Let us for a moment forget the important point that they – in a complex and only partly known way – control the growth of an organism, and thereby its characteristics. What interests me here, instead, is the immense stability of the genetic material. On the one hand, the organism grows out of the initially fertilized egg through a long series of divisions, in which the original set of genes is replicated exactly in identical form at each step. The initial genome is kept constant throughout the life of the organism. It does not degenerate, it is not diluted in some way, the spiral is not tangled into a final chaotic mesh. The giant macro-molecule keeps its exact form – even when the organism it has produced, slowly ages into ultimate disintegration.

On the other hand, the genes are copied or replicated in the mechanisms of sexual reproduction – *meiosis/mitosis* – in a stable and unchanged form, through generations of organisms. So, it is often claimed, Homo Sapiens has experienced no genetic evolutionary change during the last ten thousand years. And the genetic difference between man and his closest cousin the chimpanzee amounts but to 1.2 percent of the genetic material, despite an evolutionary distance of something like ten million years. (The assumption is, that we have a common ancestor five million years back in time, but this means five million years of non-common development for each species, adding up to ten million of growing genetic evolutionary distance.) This stability, moreover, is nothing special just for humans. The same principle goes for much more primitive organisms.

In the process of sexual division, the gene spiral, the helix, replicates itself, i.e., creates a copy of itself. It is a copy which in every detail, every molecule, indeed every atom, is a perfect mirror of the original. As the time-related description above indicates, this exactness is comparable to a copying machine capable of flawlessly copying a series of copies, one upon each other, successively a thousand times, maybe ten or fifty or a hundred thousand times – without any trace of blurring. Even with the high quality copying machines we have today, any text copied successively a hundred times would be completely unreadable.

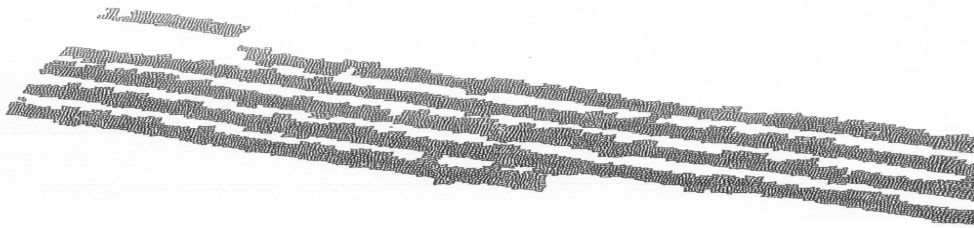


Figure 4: This is the first paragraph in this paper, as written in Times New Roman, 12 points, and copied successively, copy upon copy by the author on a state of the art Lanier office copying machine, and thereafter scanned in a Canon 1220 U flatbed scanner. For some reason, probably in the copying machine, the whole text slowly slid downwards to the right. (The stubbed right end comes from the border of the scanner surface.)

The replicating mechanism of the genetic material is as exact as the meaning of that word might be. Or, more to the point: it is *almost* as exact. Now and then there are small disturbances in this mechanism, called *mutations*. (That the possibilities of mistakes are in fact much more complex, and still not known in every detail, has no relevance for the argument below.)



These mistakes are not without significance. The predominant majority of these disturbances are assumed to result in the failure of the copying mechanism, in the meaning that no new living organism will be born, or that, if born, its probability of survival and further reproduction is diminished. Sometimes, however, the mutation leads to better chances for survival and reproduction in the evolutionary struggle for life space. That is how evolution strides forward.

This means that, from an evolutionary perspective, mutations are necessary and unavoidable. If the replication of the genetic material were absolutely perfect, with no errors whatsoever, then we – to exaggerate slightly perhaps – would all still be primitive Radiolaria. No evolution would have taken place. The 3.5 billion years that life has had to develop since its beginning on earth, would not have been long enough for evolution to produce such a complex being as man. Not even a small fish would have been possible, probably nothing at all. Absolute perfection, perfect stability in the replicating process, in this way will produce only a petrified standstill, *stasis*.

But we can look at the whole question from the opposite point of view. If the frequency of mutations were too high, then the stability and the patterns able to change under the pressure of the evolutionary forces would never arise. In order for a change to happen, there must be some kind of stable pattern, *which can be changed*. With too high a frequency of mutations we would all, accordingly, be something like cancer growths. But, of course, this could not happen because in that case, too, there would have been no stable evolution to lead so far.

This gives us a basis for a simple hypothesis, which, as I shall try to show loosely below, might be seen as a general proposition about the characteristics and existential limits of *living systems* as such. Effectively functioning genetic material exists in a narrow interval between *stability* and *variability*. We can imagine a delicate quotient S/V , where life balances as if on the sharp edge of a knife. On the one side, “behind us” in the processes of evolution, lies the petrifying death of too high stability. On the other side, “ahead”, lies chaos, produced by too much variability and over-rapid change. In between, within a very narrow sector, *a narrow border zone*, sustained by the perfectly balanced blend of S/V , life flows on. Life exists at the edge of chaos. Behind us lies death, ahead of us lies death. Between them, life.

We can look at the question from a slightly different perspective: The human genome, thus, seems to be characterized by a very stable combination of S/V , a specific blend of dominant stability constantly disturbed by a very finely tuned input of variability. Mutations, and with them all the other complex disturbances in the chain of exact replication are not therefore mistakes; they are an in-built propensity of the material. (For a closer discussion of the ideas regarding inherent propensities, see Popper, 1990) Material lacking the propensity to mutate has been sifted out by the evolutionary process of natural selection. The same has happened with genetic material with too high a degree of instability, i.e., mutability. All higher life, we must assume, is built on this material. And, one might guess, very primitive life forms – such as radiolarians – might have a slightly higher degree of S . Other forms, like the HIV-viruses, clearly might have a higher degree of V .³

³ On the other hand there is no need to assume that all material of too high stability must be eliminated by evolution. Some might hang on quite well as “archaic” elements. As is now known, a predominant part of the human genome is in fact inactive, just hanging on. This genetic material, then, might at least partly be what we have common with our early ancestors.



In his study of self-organizing systems and complexity – “At Home in the Universe” – Stuart Kauffman points out exactly this, namely that life is a “non-equilibrium system”, a slow but constant process of evolution. According to him, “Life exists at the edge of chaos”. Borrowing terminology from physics, he notes that “life may exist near a kind of phase transition.” Water, he adds, may exist in three different phases: as ice, as liquid water, and as steam. He conjectures that the same principles might govern complex adaptive systems: “For example we will see that the genomic networks that control development from zygote to adult can exist in three major regimes: a frozen ordered regime, a gaseous chaotic regime, and a kind of liquid regime located in the region between order and chaos. It is a lovely hypothesis with considerable supporting data, that genomic systems lie in the ordered regime near the phase transition to chaos.” (Kauffman, 1995, p. 26)

So let us play a little with this thought. It seems, if we develop it, as if evolution might proceed as a set of “Russian dolls”. In order to attain stable existence, simple organic units – like viruses – must reach a kind of evolutionary semi-balance between S and V. This is something of an unavoidable necessity, accepting the above thesis; behind them, in too great stability, lies the backwater of evolutionary standstill. You can live there, at least for a time, but sooner or later other organisms will evolve, forcing you away from the battlefield of survival – or to evolve, to adopt to the new threats. Ahead, in the chaos of too much variation, lies immediate extinction, nature’s mechanically trivial elimination of non-functioning solutions. And between these extremes, the perfect quotient of S/V offers some organisms a steady and slow surfing on the crest of the evolutionary wave.

This surfing, then, becomes *a new state of stability per se* – like riding a bicycle on a flat road, or like water-skiing on calm water. When you reach the point where you can master it fully, the whole thing turns into a rather ordinary and boring routine.⁴

The process of change does not, however, end here. It is possible to keep the attained S/V quotient stable, and still have change. This seems to have happened several times during evolution. At some time, in a way not yet completely understood, simple organisms “choose” a more complex way of reproduction, than that of simple division. During some phase of their life cycle two unicellular organisms join, melting or merging into a single cell, “mixing” their genetic material – and thereafter divide again into two separate “new” ones. (This mixing of organisms is, *per se*, something that has happened in many different ways. Thus parts of the human cell – organelles, mitochondria – are assumed initially to have been free bacteria-like organisms that somehow took up residence within the cell and which now are important working parts of it. (Lewontin, 2000, Margulis, 1998))

This opens up for a new avenue of variability, not by the slow process of mutations, but by mixing already existing stable varieties. In a world of non-sexual reproduction, every individual family chain will of necessity form its own evolutionary line. Sexual reproduction breaks this endless linearity. Suddenly whole new sets of combinations, transgressing the borders between formerly isolated lines, come into being. This new variability, then, meets the *evolutionary pressure* of Darwin’s natural selection – in the constant struggle for survival and for reproduction, some varieties succeed, while other lose out.

⁴ And – a point worth stressing – as soon as that “steady state” of undisturbed skilful and stable water skiing is reached, most skiers are prone to start experimenting with ever more difficult variations. Not only in the genetic material, but – it would seem – also in human mind, are hidden elements or mechanisms which force us onward towards instability, even chaos, as soon as a reasonably stable situation is reached. Just hanging on behind the speedboat – “that’s too boring”.



What happens, is that the basic genetic material maintains its stability, but a new dimension of variability is added. The DNA molecule retains the stable relation of S/V , attained through eons of evolution, but it is “enclosed” within a “surface” of new variability – $(S/V)/V$ – and this new border area confronts the surrounding evolutionary selection mechanism(s).

As a result of this, the speed of evolution, the relative “rate of change”, increases. The basic material still keeps evolving at the same slow pace as before, but to some organisms *is added* a new and faster change mechanism. We could therefore expect that organisms that reproduce only by cellular division have been evolving more slowly – and therefore would not have evolved as far (on a scale of rising complexity) as organisms that reproduce sexually. The radiolaria are said to be among the oldest still living species, in the meaning of surviving unchanged through evolution. They have not undergone any significant change during the last 3 billion years or so. (Stressing the point a little, there might still live an identical twin of an organism living 3 billion years ago, copied in an endless chain of cellular division.) Man, again, belongs to a long line of organisms that reproduce sexually; a line that long ago started at the same point, but that on its way through time came to follow a more complexity – and variability-ridden road.

If we want to go on playing with the S/V quotient, it is easy to see that another surface of variation can be added, giving us $((S/V)/V)/V$, namely the capacity for self-propulsion. Self-propelling primitive organisms soon acquire some kind of teleological properties, they can move to areas rich with nutrients and away from those that lack them. They can seek out sexual partners, they can escape hunting predators, they can become hunters themselves. Teleological moving organisms, thus, *can make “choices”*. These simple choice mechanisms, of course, have little to do with the discussion regarding human free will, but the point of teleology nevertheless lies in the possibility and capacity of choice. It means seeking out and going for a goal – in relation to missing it. A missile fired from a cannon is not *per se* a teleological phenomenon. It is just a case of causality belonging to classical physical mechanics. A goal seeking cruise missile, on the other hand, is teleological – it chooses actively between different possible routes, as it speeds over the landscape in search of the most suitable course to its destination.

To be able to choose from aspects of your environment – food, prey, sexual partner, and so on – is basically a capacity to adapt, to change in relation to the environment. Teleology and choice accordingly offer the organism an added plasticity in relation to the environment, to its threats and to its possibilities. It opens up a new potential for survival, and thereby a new avenue for evolutionary pressure (see below) speeding up the “clock rate” of evolution another notch. Teleology means that you suddenly can run faster again – but, sooner or later, so can everybody else.

Each added surface of variation, thus, opens up for new evolutionary pressure. The whole set can also be seen from another perspective: in the harsh life of nature’s constant struggle for survival, some variants will be sorted out, while others survive. For this to happen, however, *there must exist variants among which selection is possible*. There must be something stable or semi-stable which exists in a set of varieties, they must have some kind of a semi-stable existence. Otherwise “selection” is impossible – logically as well as in practice. For a selection – naturally spontaneous or intentional – to happen, the varieties must therefore be bound to some dimension of background stability. And, as far as this stability exists – body height, hair colour, intelligence, tail length, strength, indeed whatever imaginable – its border areas or



surfaces of variability will drive the change of the whole, i.e. the non-equilibrium system, further.

So far we have mainly discussed stable variants, meaning genetically determined S/V quotients. The set of Russian dolls has been built up by adding dimensions of genetically established plasticity in relation to the evolutionary pressure that the surrounding environment contextually places in the way of the organism. This plasticity comes early in evolution. Many plants, e.g., have a capacity to fit their size to the benignancy of the spot in which their seeds happen to fall. They may grow higher in order to reach enough light. They stay smaller – even in cases of identical clones – in dry and arid or stormy places.

The capacity for self-propulsion, of moving, as noted above, is a more complex form of plasticity, because the organism can choose its environment, thereby enhancing its chances for survival and reproduction. This means that the capacity of choosing, its plasticity, becomes pivotal. Self-propelling organisms therefore usually also have some capacity of learning. Their behaviour is not merely governed by genetically determined reflexes, activated by environmental stimuli. Even rather primitive organisms, thus, have such an advanced learning capacity, that their survival has become dependent on behavioural skills achieved during early life and adolescence. Many vertebrae – from birds (Bonner, 1980) and rats (Zentall, 1996) to chimpanzees (Wrangham and Peterson, 1996, Whiten et al., 1999) and, of course, humans – have a genetically determined highly sophisticated capacity for *social learning*. (Heyes and Galef, 1996) They imitate older members of the family, flock or tribe, especially their parents, and thus have the capacity of utilising “second-hand knowledge”, i.e., contextually functional behavioural patterns previously developed and tested by others – possibly even generations earlier. This phenomenon is called *memetics* – from the concept of “*meme*” as opposed to “*gene*”, introduced by Richard Dawkins (1976) – and may be seen as a conceptual basic mechanism for that phenomenon, which in human contexts is called *culture*.

Culture – especially the culture of man – thus constitutes an additional layer of variability encircling the relatively stable construction Homo Sapiens, which in itself, as noted, is assumed not to have undergone any genetic evolution during the last 10,000 years. As a life form, as behaviour and life conditions, however, the changes during that period have been dramatic, transforming humanity as such to great extent. Even if they are genetically and biologically identical, there is little in common in the existential humanities of Stone Age man and Modern Man.

Because of the high speed of change in the outermost Russian doll, namely that of “culture”, stone age man has developed the capacity to fly in space like a bird and to communicate instantaneously around the world. As Norbert Elias (Elias, 1991) notes, this is not in any way an “unnatural” phenomenon. On the contrary, culture has grown out of nature, from biology. It presupposes a complicated genetic evolution – in a world of primitive algae alone, there would be none of Beethoven’s symphonies – but it functions on the phenotypical level. In the discussion regarding nature vs. culture, the latter, however, appears to be *a new kind* and *a different kind* of nature than the earlier ones, and to possess new emergent characteristics. I have treated the basic mechanisms of culture elsewhere (Gustafsson, 1994. See also Dawkins, 1976, 1983 and Dennett, 1991) and shall therefore not delve more deeply into that question here. But, it is worth stressing the point, that culture – an effect of man’s overwhelming capacity for social learning – adds one or maybe several more dimensions of Russian dolls.



Above all, culture brings a dramatically increasing plasticity in the scope for human traits. The plasticity per se means an increase in the spectrum of variation. Man can fly, without “flying genes” and without any kind of phenotypic organs for flying (wings, etc.). He can live in very cold as well as in very hot and dry climates, he can, to a degree, move around in the near vacuum of space, as well as deep in the sea. He can vary his food endlessly, he can communicate directly with people on the other side of the globe, even appear in the form of moving pictures. He can reach out around the globe, touching and manipulating things on its other side.⁵ Not only is he skilled at adopting to his environment; he can also to a great degree adapt his environment to his wishes. He can create new types of environment, and so on, *ad nauseam*. Humans, moreover, can construct complex organisations in order further to adapt themselves. They develop systems of kindergartens, schools and universities to train their young in advanced and complex techniques for adaptation, and each time they do so, they take a new step in the endless process of natural selection. Knowledge and education is, as we all know, the key to success in the modern global competition going on between nations and cultures.

The interesting point here is that, as a matter of principle, the inner boxes, i.e., the S/V quotient and the structure of the genetic material, are left more or less completely unchanged in this selection process. All earlier evolution has required and resulted in changes in the genetic material of the organism. But for a long time now, man’s struggle for survival – in relation to the environment as well as to other men – has taken place not by genetic evolution, but by a memetic one, i.e., by cultural evolution. What now competes, what is eradicated by others or is selected into the future, are not new genes and genomes, but new forms and variants of culture – organisations, social structures, technical innovations, computer systems and software – in layer upon layer. At the frontier of this evolution, it seems, today stands the Virtual Reality shaped by the *Internet*, including new non-organic, self-generating and self-evolving life forms in the shape of computer viruses. But the struggle and competition for survival goes on – it is here we find the edge of chaos.

⁵ Which is what happens when a surgeon in, say, Stockholm, using medical robots connected through the Internet, performs a surgical operation on, say, a patient in Sydney. Even though he is using technically developed sophisticated instruments, he is still – like the chimpanzee catching termites using a twig as instrument – the one making the incision. Despite the distance, his hand directs the scalpel according to his choice.



3. Mechanisms of change

We all know Alice, and we have read about her adventures in Wonderland. At one place she meets a strange Red Queen, a very stern chessboard figure. She goes around ordering and commanding people, reacting curtly to any sign of disobedience.

When they are walking in the park, for some reason they suddenly start running. Soon they are running as fast as Alice can, but the Queen keeps crying “Faster! Faster!”. Alice tries harder, but the Queen only commands her to run still faster. “And they went so fast that at last they seemed to skim through the air, hardly touching the ground with their feet...” When they stop, however, Alice, now quite exhausted, finds that they have been getting nowhere:

“Why, I do believe we’ve been under this tree the whole time! Everything’s just as it was!”

“Of course it is,” said the Queen. “What would you have it?”

“Well, in our country,” said Alice, still panting a little, “you’d generally get to somewhere else – if you ran very fast for a long time as we’ve been doing.”

“A slow sort of country!” said the Queen. “Now, here, you see, it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run twice as fast as that.”

So they double the speed, but they still get nowhere. And so it goes, on and on. However fast you run, you will still get nowhere. In order to get somewhere you always need to double your speed – forever and forever.

In his book “The Blind Watchmaker” (1988) Richard Dawkins shows how this “*Principle of the Red Queen*” can be applied to evolutionary theory, where it constitutes something of a *general law of nature*. We can take the evolutionary relation between foxes and hares – a typical case of a “predator/prey relation”. The foxes eat hares, and so stay alive; the hares try to avoid being eaten by the foxes, and thus, in turn, survive by outrunning them. In that mutual struggle for survival, the slowest hares will sooner or later get caught by the foxes, and be eaten. The faster hares, again, will survive and reproduce. Physical fitness being a hereditary characteristic, this will in time lead to ever fleetier hares – evolution has taken a step forward.

This however, does not help the hares very much. When they become faster, the foxes face problems: they can no longer catch their food. Or, more to the point, *the slowest* among the foxes will starve to death. And the remaining, somewhat faster foxes will be the only ones to reproduce. So in due time the foxes, too, will become ever faster.

In this way nature rolls one more step forward. The hares are ever running faster, but still cannot avoid getting caught by the foxes. The foxes, on their side, are also running faster and faster, but they will still have problems catching a hare. Regardless of how fast they run, both of them, they seem to get nowhere. Their life, balancing on the edge of extinction, is still the same torment – brutish and short, as Thomas Hobbes would have put it.

The Red Queen reigns not in nature alone. Basically, the liberal market economy is an evolutionary model. If everybody fights against each other on a market, says Adam Smith in a sharp insight long before Darwin, they will be forced to lower their prices and improve their



products in and endless spiral of competition. Let egoistic and opportunistic economic actors compete freely on a market, writes Smith, and, *as if governed by an invisible hand*, this common activity will lead to the betterment of everybody's life – even if none of the actors strives for that result. Every price reduction results in a counter-move from the competitors, every new product too. Regardless of how fast our manager runs, he gets nowhere – his competitors are always at his heels, biting at his hind legs. Sweat running down his forehead, his stomach churning with stress, he is still forced to try to run harder – life is the same pain as before.

The Red Queen is, it would seem, one of the central mechanisms driving *the balanced wave of unbalance* forever forward. It is identical with Charles Darwin's dynamic principle of "natural selection", the key mechanism explaining evolution. It is a further consequence of the Malthusian principle of limits to growth. In a benign environment, any species will multiply, until it exhausts the abundance of resources. Sooner or later, therefore, it comes to a limit, where some part of the environment will inhibit and ultimately stop the growth. Famine, diseases, predators, will weed out the "weakest" members of the population. There is, in nature, nothing like random death or random survival. Every specific death, in fact, is special, individual and contextual. But, still, the special contexts, causes and specific deaths form patterns.

For any species, moreover, there are many borders, many interfaces of struggle in relation to an innumerable mass of environmental phenomena forcing a selective pressure on it. The hare's problem lies not only in foxes, but in lice, mice, grass and clover, in owls, in humans, in cars, in rain and in sunshine. Most things can be good for you or bad for you, depending on the context. On a general level, of course.

Every living system – a cell, an animal, a human, a family, a corporation, a society, a culture, a computer virus – thus has countless friction surfaces, more or less chaotic borders, Russian dolls in layer upon layer, in recursive relationships, in balance or unbalance. As far as and as long as they succeed in maintaining this dynamic stability, this balance of unbalance, as long as they stay surfing on the crest of the wave, *they exist*. An ecosystem is a network of open systems, or of network upon network of subsystems, constantly and dynamically balancing against each other and within each other. This balancing never reaches a stable, unchanging equilibrium. The points of balance, instead, are constantly moving.

And together they constitute the reality, the world that exists. The dynamic processes of emergence shape small islets of *living idiergic stability* in the endless black sea of chaos. Small dots – or narrow lines – in complex networks of critical balance, light up the endless multidimensional space of nothingness. Chaos, absolute chaos, as well as "subjective chaos", is often defined as a state of total lack of regularities, patterns or structures. It cannot, therefore, be seen, measured or even detected *as such*, it is the ultimate void – and so does not exist, empirically, in our "reality". The whole that we can see, consists of the idiergic wave crests, of small islands dotting the endless sea of nothingness like stars against the black sky. The dots, the lines, the networks glowing here and there, light up the blackness of chaos. Together they form the observable reality. Because behind them there is nothing to see, nothing more to observe.



4. Towards a theory of emergence

We are all familiar with Thomas Kuhn's (Kuhn, 1975) conceptual construction of scientific "paradigms". By these he means something like patterns of scientific reasoning common to scientists within a given discipline; a common, well established, and more or less unchallenged picture of what the reality looks like and how it ought to be studied. What is interesting with paradigms, and what is not talked about so much, is that a well established paradigm will be focussed not only on a conception of a correct method, but also to the same degree, on a correct format for the results. Accordingly, results that deviate from the accepted form, will not on the whole be observed. They are either ignored completely or will fail to arouse interest. One example of this is the scant interest traditional economists show for the broad and unanimous evidence of the lack of empirical realism in the theoretical basic assumptions. Another example is to be found in the surviving belief in rational models within the management sciences. Regardless of decades of empirical research that demonstrate the importance of organizational phenomena of extremely high complexity and vagueness, we still go on looking for ultimate simple and static data. These are, in some way, assumed to provide a platform on which we can build simple – often normative – general theories of business organizations, which, as some kind of automata, would have the power of explaining and predicting future economic events in detail.

In the perspective sketched loosely above, we probably will need other kinds of theories and may have to look for other kinds of data. Today's paradigm still favours the collection and comparison of statistical averages, of data given once and for all. It is astonishing sometimes to see the interest and exhilaration that small and completely meaningless measures of statistically significant variations can give rise to – it is as if these could automatically offer the researcher a deep, but for the uninitiated observer inexplicable, feeling of understanding something. This feeling of understanding where there is nothing to be understood, is what is produced by a strong paradigm.

So we might ask what consequences this picture of life, ideas and organisations, as existing on the top of a wave, rushing forward in a dynamic balance between stasis and chaos, might have from a methodological perspective. In another context (Gustafsson, 1994) I called this approach "neo-structural", in the sense that reality constantly forms or structures itself.⁶ A better term, however, might be that used by Stuart Kauffman (Kauffman, 1996) and Norbert Elias (Elias, 1991) – namely "*a theory of emergence*". The world outside is changing all the time, however slowly and un-noticeably. It *emerges*, it "consists of" a constant birth of new phenomena, new structures, new life forms.

Such a perspective is not going to produce a great deal of stable and exact statistical data. Rather it can be expected to lead to "understanding" of processes, patterns and loosely law-like regularities

In the field of management studies, the balance between stability and variability points to interesting questions. It is often said that the firm, or any organization, maintains, or at least strives to establish, some state of equilibrium. Well known theoretical studies – by Chester Barnard, James G. March and Herbert Simon, Eric Rhenman, James D. Thompson, to name but a few – have been based on the assumption of or search for general equilibrium.

⁶ And, nota bene, this "construction" has very little to do with the ideas of "social constructionism".



Seldom, however, do we find these equilibriums in real life. Even more to the point, rarely will you meet a CEO who tells you that his job is to keep the company in some kind of state of ultimate equilibrium. Rather, you might say, business firms stay alive by constantly stumbling forward – neither standing still nor toppling over – at the edge of chaos. One step too many or too quickly, and they are in trouble, one step too few or too slowly, and their troubles may cease for ever.

The eternal pain of management is that you have to use your energy and your skill to the utmost, in order to finish the year a little better than last year. Then, just when you have succeeded with this effort, you have a new year, and must excel yourself once again. The rapidly moving wave of global capital is now at the speed not only of the relative increase of profit but of the changes in that relationship. Before long it will not merely be a question of running twice as fast, but, maybe, of doubling the pace of acceleration. Because “*here*, you see, it takes all the running *you* can do, to keep in the same place. If you want to get somewhere else, you must run twice as fast as that.”

The Companies, again, defend themselves and attain new profitability by manipulating the S/V relationships with the help of new Russian dolls. Organization, ownership structures, outsourcing, JIT-systems, modularising production – in layer upon layer.⁷

In whatever dimension of study you might choose, the relevant and interesting environment or context of the living organisation consists of a border zone, a wave constantly rolling forward in time. It is a moving landscape of competition and a struggle for survival and profit. Each time you develop new products, there are competitors doing the same, each time you trim your processes, somebody else has trimmed them too. Technological development as a whole is very much a global wave, where the specific choice of any actor is of minor importance. It rolls forward with an inertia-like stability. On this wave we can see companies balancing, some of them stumbling forward into instant extinction, others leaning backwards into slow decline, and some, just at the fore of the breaking wave, skilfully maintaining the delicate balance.

Organisations, therefore, utilise nature’s method for eating their cake and still keeping it – carefully planned standardisation is combined with a high degree of flexibility and variability. The latter is not an exclusively negative fact. The border to chaos is the place where the chances of profit are greatest. The static application of well known and secure methods and techniques is something anybody can do, and those who adhere to them for a long time will soon quietly leave the scene through the back door. The more globalized the economy and the faster the reactions of the economic actors, the less interesting the stable local economy will become. The successful companies – and their managers – are forced to step still a little further, forward into the foam of the breaking wave. Because it is there, just before you stumble head first into chaotic oblivion, that the vital spirit of the economy exists.

Maybe it is this balancing skill, ability to surf on the wave, that is the central task of a skilful manager. More to the point, managerial skill may lie in the innovative use of the Russian dolls at hand, in finding, choosing among, and utilising the “opportunities” that arise close to chaos, just before the competitors do – and then, again, to move on. And this skill, we might conjecture, is much more a question of intuition and of aesthetic feeling, than of calculating intellect.

⁷ In his book “Organizations in Action” (1967) James D Thompson discusses this phenomenon from a slightly differing perspective – as “buffers” protecting the central core of the organization from outside disturbance.



Anybody can read a book about surfing, but to do it, balancing on the breaking wave, is something that you can learn by practice only. It may be the case that some people are better at keeping their balance – possess some kind of superior motor skill – than others, and why this is so is not completely known. We do know, however, that learning to surf, like learning to play a violin, demands a lot of training.

It is also a question of courage. Courage is not exclusively a romantic concept; it may also be important in demanding and threatening situations. As Alasdair MacIntyre notes in his study of the classical virtues (MacIntyre, 1985) in ancient Greece, a world of constant war, robbery and slaughter, courage was an important human virtue – if you were not willing and able to defend you family, village or city, your prospects of a happy life were indeed negligible. A certain amount of courage and daring is also needed if you want to move forward on the wave. You have to move ahead, dare to take one more step than your competitors, be so far ahead that you almost trip forward – almost, although you can still keep your balance.

Choosing where to stand and when to do so is, however, not only a question of courage, but also one of intellectual alertness and of creative feeling, because there is not only one wave, but many, uncountable ones, rushing forward in different directions. As with the surfer, who moves forward by choosing the most promising spots and positions on the breaking wave, there is always an element of searching vigilance and creative inventiveness in the logic of economic action. The skill of an entrepreneur, thus, lies not so much in his power to move forward, as in his dexterity in using the forces and dynamics that reside in the complex and constantly changing force field of economic action. Being an entrepreneur, accordingly, is not so much a question of exerting power. Instead you must do as Darth Vader: “Use the Force” – not in this case the power of the crystal sword, but the immense force of the advancing wave. If you choose the right place to position yourself, the force of the wave will sweep you on.



5. The second law

As a general rule, “business”, in the meaning of complex instrumental economic action, seems to withdraw or move away from standardised and simple environments. The reasons for this are simple. In a totally transparent and completely controllable situation, as in the technically and economically *perfect market*, the scope for profit – for both trivial and practical reasons – approaches zero. Any dynamic enterprise, therefore, reaches – or is forced by competition to reach – for the frontiers where the difficulties are greater and with them also the risks. Even if this might not be the case as a kind of generalised average, it will most certainly seem to be so for those confident in their own capacity and skill. The potential for profit and reward is to be found where life is difficult and risky. Because of this, the race forward is deemed to go on forever, instead of stopping at some assumed utopian state, where everybody is prosperous, happy and content.

This, we might say, constitutes the “*second law of the market economy*”.⁸

Let us look a little closer at these presumed “laws”. The “*first law*” of the market economy, of the dynamics of the “free market”, consists, of course, of Adam Smith’s “invisible hand”. If completely autonomous actors – businessmen, companies, etc. – compete in a free, unregulated market, each of them opportunistically acting only in his own egoistic interest, then, “as governed by an invisible hand”, says Smith, the common result will be commodities with lower prices and higher quality. In other words, the result of this dynamic interaction – to which nobody strives – is a better life for everyone. The idea of the free market, thus, has become the ideological cornerstone of utilitarian capitalistic political systems over the world. “Let everybody compete freely, without any consideration of his neighbour’s happiness, and everybody will in the end live a happy and fulfilling life.

Like any “law”, this one is assumed to be valid in principle, in the abstracted generalised case, even if in the messy reality we may find contradictory instances. (So the law of gravity tells us that all things, as *a matter of principle*, should fall down. Actually aeroplanes, kites and satellites do not, but for those “special cases” we always have special *ad hoc* explanations.) Or, if we turn the argument around: reality consist of special cases; nobody has ever seen a living, well functioning general case. As Paul Feyerabend demonstrates so well in his posthumous book *Conquest of Abundance* (1999) scientists tend systematically to cleanse their experiments of “realism”. In the typical scientific experiment, any disturbance, every dust particle, vibration, temperature variation, etc, apart from those few variables being studied, is excluded – often with great and costly effort. One of the important skills of an experimental scientist within the natural sciences, in fact, lies in being able to weed out nature from the experimental environment. Most empirical experiments are therefore made in highly artificial contexts, such that would never exist in “real living nature”.

Still the generalised theory is important. It helps us *understand* dynamic patterns in a messy reality. So even if we may never find that unregulated economic interaction and competition between absolutely free and extremely simple minded brutish actors, we still have an

⁸ In the perspective of the discussion above, it may seem to be a “second law” of much more, maybe of life as such. In our context here, however, we might delimit it to a “special theory” regarding economy, management and organization.



instrument to help us understand the dynamics of the chaotic markets around us. And that, indeed, is good enough for any theory.

The same goes for the “*second law*” proposed here. It is, as such, based on the first law, but it adds a somewhat unexpected dynamic movement. The final utopian heaven sometimes proposed as the result of the free market – and, surprising as it might seem, also by the Marxist doctrine – where prices are negligible and perfect products filling any conceivable need are abundant, is never going to exist. At any moment, innumerable and inestimable new idiergic ripples and waves may emerge, creating possibilities for somebody to take one more step forwards, to utilise forces formed by the evolutionary state reached.

On the one hand, this is an inevitable result of any final prior step that may have been taken. A technical innovation, say the personal computer, sooner or later gives rise to an unexpected new development – like the Internet and the ensuing strong technical development in sales techniques required by the explosion in this new avenue for purveying pornography. Take computer viruses – and the evolution in anti-virus programs. Take the way children played with a technical curiosity in early mobile phones that led to the explosion of the SMS-market, take the I-Pod, take the new music market and new forms of software piracy.

On the other hand human culture seems to evolve into more and more innovation-seeking forms. As for the mutability steadily built into the S/V quotient of the genetic material, we may assume that modern highly developed cultures possess an inherent drive for betterment, for development, for innovation and for future potential. Ours is, as James G. March and Herbert Simon noted in the fifties (March and Simon, 1958) a culture that believes unfalteringly in a benign world – if you just try hard enough, you will find a solution to any problem. This positive life expectation has not been as pronounced in earlier cultures, but is clearly discernible in the writers of the Enlightenment, especially so in the modern practical reason, as found in Benjamin Franklin’s famous moral principles. Work hard, avoid talking too much, be suitably thrifty and try to act reasonably in all spheres of life, and you are bound to be happy and prosperous.

The modes of human interaction most thoroughly imbued with this optimistic compulsory drive to search constantly for new and better ways and solutions, are, of course, the modern corporation and, to a degree, the modern university. Taking up the concept of “corporate culture”, we could say that maybe its most important trait is exactly this search for innovation, for betterment and for going on one step further all the time. Even more, in the brains of each of the young managers striving for advancement and a higher salary, the idea of doing something extra can be seen as the most dominant aspect of the mechanisms of economic rationality. So be smart, work harder, be just a little better and more innovative than your competitor – be it another individual or another company – and heaven will be yours. The drive forward is hidden not only in our genes, but to at least the same degree in our memes.

So for the modern corporation, however hard it tries, the situation is still going to be the same as for Alice, for the hares, and for the foxes: each success opens the door to new avenues, not only for you, but also for your competitors. Every problem solved, creates a new one somewhere else. And if you fail to see it, somebody else will – and there you are again, stuck in the treadmill. The faster you run, the harder you will have to. It never ends. Life is the same torment as before

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Like Alice's, this race will never stop. There is not going to be a state where everybody will in the end live a happy, rich, and peaceful life. Instead, whenever you think that the race is over and that the state of ultimate market economy bliss envisaged by Adam Smith will prevail forever, with an abundance of high quality wares and products freely available for everybody, somebody will invent a new avenue for competition, a new way of producing a scarcity that he can exploit for profit – and to your loss. Yes, the principle of the first law is correct and in full effect. But there is one more mechanism at work, also built into the core of the system. This is the principle of idiergy, the dynamics of chaotic border lines. The process driven by the mechanism of the first law, constantly refining the efficiency of the economy, is paralleled by another one, constantly adding new parameters to the process.

This, you might say, is the basic mechanism of *the second law*: Whenever the process governed by the first law is close to completion and impending conclusion, as it approaches the state of final and total stability the focus of the search for risk, variability, and profit will shift. The principle of life is not to attain complete stability and lethargic rest, but to balance dangerously on the crest of the wave between S and V. And there we go again.

This comment is not, however, meant to be pessimistic. The second law, on the contrary, describes what is happening all the time, and thus explains for the managers, in a rather trivial way, the terms on which they act, how they live and act as a manager. Being distressed by the facts of rain and sunshine, is not what our central values are about. And given that, *the second law* just pinpoints the framework in which we work. In order to acquire a competitive edge, you *must* live in an environment where there is something to compete about – profit – and something to compete with – skill, competence and power. This never-ending mess, this constant stumbling forward where nothing seems ever to work perfectly, is just plain normal. And if it ever seems to be perfect, look out. Environments where special skills and competence are not needed, are dangerous places. Competition and success constitute a situation of dynamic stability, of ordinary chaos. So keep moving, just a little faster than your competitors, and look for the abundance of opportunities that lies just ahead. And watch out, don't stumble.



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Pink Machine is the name of a research project currently carried out at the Department of Industrial Economics and Management at the Royal Institute of Technology, Stockholm. It aims to study the often forgotten non-serious driving forces of technical and economical development. We live indeed in the reality of the artificial, one in which technology has created, constructed and reshaped almost everything that surrounds us. If we look around us in the modern world, we see that it consists of things, of artefacts. Even the immaterial is formed and created by technology - driven by the imperative of the economic rationale.

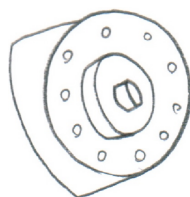
As Lev Vygotsky and Susanne Langer have pointed out, all things around us, all these technological wonders, have their first origin in someone's fantasies, dreams, hallucinations and visions. These things, which through their demand govern local and global economical processes, have little to do with what we usually regard as "basic human needs". It is rather so, it could be argued, that the economy at large is governed by human's unbounded thirst for jewellery, toys and entertainment. For some reason - the inherent urge of science for being taken seriously, maybe - these aspects have been recognised only in a very limited way within technological and economical research.

The seriousness of science is grey, Goethe said, whereas the colour of life glows green. We want to bring forward yet another colour, that of frivolity, and it is pink.

The Pink Machine Papers is our attempt to widen the perspective a bit, to give science a streak of pink. We would like to create a forum for half-finished scientific reports, of philosophical guesses and drafts. We want thus to conduct a dialogue which is based on current research and which gives us the opportunity to present our scientific ideas before we develop them into concluding and rigid - grey - reports and theses.

Finally: the name "Pink Machine" comes from an interview carried out in connection with heavy industrial constructions, where the buyer of a diesel power plant worth several hundred million dollars confessed that he would have preferred his machines to be pink.

Claes Gustafsson



also available at
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